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Pikas in Peril: Multiregional vulnerability assessment of a climate-sensitive sentinel species

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Abstract: A large team of National Park Service (NPS) staff and academic researchers are collaborating on a three-year research project funded through the NPS Climate Change Response Program. The "Pikas in Peril" research team hopes to address questions regarding the vulnerability of the American pika (*Ochotona princeps*), a species sensitive to temperature and climate, to future climate change scenarios projected for the western United States. The project objectives are to (1) document pika occurrence patterns and predict pika distribution across eight national parks in the western United States; (2) measure gene flow and model connectivity of pika populations in five of those parks; and (3) project climate change effects on the future distribution, connectivity, and vulnerability of pika populations in each park. Systematic pika occupancy surveys were conducted in 2010 and 2011 across a range of latitudes, longitudes, elevations, and substrate types (talus slopes vs. lava beds). Analyses of DNA extracted from fecal pellets collected during occupancy surveys will document recent gene flow patterns. The distribution, habitat, connectivity, and genetic data and models will be combined to conduct a quantitative vulnerability assessment that explicitly predicts pika response to climate change. By assessing the vulnerability of this sentinel species, the research team will provide park managers with insights into the expected rate and magnitude of climate-related changes in park ecosystems and critical information for park scenario planning and interpretive goals.

Key Words: American pika, monitoring, occupancy, *Ochotona princeps*, vulnerability assessment

Introduction

NPS/Doug Owen

Figure 1. Many believe that pikas only occur in high-elevation talus habitat. However, the American pika can be found as low as sea level, especially in the northern portion of its range, and in other fragmented rock structures, such as the lava beds found at Craters of the Moon National Monument and Preserve (illustrated) and Lava Beds National Monument.

Resource managers from eight western national parks and three universities are collaborating on a research project to document American pika (*Ochotona princeps*) occurrence, predict distribution patterns, measure gene flow and connectivity of populations, and assess vulnerability of pika to climate change (fig. 1, above). This joint research is made possible through funding from the National Park Service Climate Change Response Program.

Parks included in this project encompass a wide variety of habitat and elevation ranges from talus slopes in alpine areas in the Rocky Mountains to lower-elevation lava flows in the Columbia Basin and Cascades. Pika researchers are collecting data for this project in Crater Lake National Park (Oregon), Craters of the Moon National Monument and Preserve (Idaho), Grand Teton National Park (Wyoming), Great Sand Dunes National Park and Preserve (Colorado), Lassen Volcanic National Park (California), Lava Beds National Monument (California), Rocky Mountain National Park (Colorado), and Yellowstone National Park (Wyoming, Montana, and Idaho) (fig. 2). Researchers from the University of Colorado–Boulder and University of Idaho, along with park biologists and seasonal technicians, conducted occupancy surveys and collected fecal DNA in 2010 and 2011. Researchers from Oregon State University are analyzing the DNA samples to assess gene flow patterns in pika populations.

Pikas and climate change

The American pika is considered a climate-sensitive sentinel species that faces increasing risk of extinction because of climate change in the western United States. Climate change assessments for sentinel species such as the pika give park managers insights into the expected rate and magnitude of ecological effects, and are critical for park scenario planning in the face of climate change.

Major knowledge gaps regarding expected effects of climate change on species distribution can easily be bridged for the pika, relative to other species. Pikas are ideal sentinel or indicator species for climate change because they are sensitive to temperature fluctuations, have small home ranges, and are easily detected. Their high visibility helps make a strong connection to visitors in national parks. Pikas must maintain their body temperature within a narrow range of only a few degrees, and a study found that when pikas are caged in the open at lower-elevation sites, extended exposure to temperatures of only 78°F (25.5°C) can be fatal (Smith 1974). Therefore, pikas tend to be restricted to boulder-strewn talus fields, often in high alpine areas and in some cases lava flows, where abundant

crevices and cavities provide sufficient cover and thermal refuge (see fig. 1, above) (Smith and Weston 1990). Additionally, since pikas are herbivorous and do not hibernate, they must collect and store food for winter survival. Consequently, both summer conditions (temperature) and winter conditions (snowpack) can affect their ability to survive and reproduce.

Pika research

The research team conducted systematic pika occupancy surveys in 2010 and again in summer 2011. These surveys occur across a range of latitudes, longitudes, elevations, and substrate types (talus slopes vs. lava beds), from which researchers will develop both park-specific and regionally appropriate habitat models for assessing pika vulnerability to climate change. Analyses of fecal DNA collected during occupancy surveys will document recent gene flow patterns. Distribution, habitat, connectivity, and genetic data and models will be combined to conduct a quantitative vulnerability assessment that explicitly predicts pika response to climate change.

In 2010, the team evaluated pika site occupancy and habitat at 677 randomly located sampling sites in eight national park units following the peer-reviewed protocol developed in the Upper Columbia Basin Network (Jeffress et al. 2011; also see the related article in this issue). Occupancy of sites was determined by surveying for pikas, pika calls, fresh food caches or "hay piles," and fresh fecal pellets in plots with a 12 m (39 ft) radius. We also collected 387 fecal samples at the five parks where genetic work is funded. Additional surveys at new and existing sites occurred in summer 2011, though the final tally of completed surveys for the year was not available as the article went to press. Analyses of occupancy results and fecal samples are ongoing and final reporting is planned for 2012.

The large geographic area of this project provides a range of local- and regional-scale information, enabling meaningful analysis of key drivers of pika distribution under a shifting climate regime. Because of the habitat requirements and limited dispersal ability of American pikas, we expect that habitat in national parks will be of increasing importance as refugia and therefore as source populations for future colonization. Anticipated products from this project include distribution maps and databases to support long-term pika management in each park, habitat connectivity models based on gene flow among selected pika populations, and climate change vulnerability assessments for pikas across the Intermountain and Pacific West regions.

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Figure 2. National parks with confirmed American pika populations and those being studied in the Pikas in Peril research.

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